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Kondo

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(54) **FIXING DEVICE AND IMAGE FORMING APPARATUS INCLUDING THE SAME**

(71) Applicant: **KYOCERA Document Solutions Inc.**, Osaka-shi, Osaka (JP)

(72) Inventor: **Akihiro Kondo**, Osaka (JP)

(73) Assignee: **KYOCERA Document Solutions Inc.**, Osaka-shi (JP)

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G03G 15/20 (2006.01)

(52) **U.S. Cl.**
CPC ***G03G 15/2028*** (2013.01); ***G03G 15/2067*** (2013.01); ***G03G 15/2085*** (2013.01)

(58) **Field of Classification Search**
CPC G03G 15/2032; G03G 15/2053; G03G 15/2067; G03G 15/2085; G03G 2215/00417
See application file for complete search history.

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Primary Examiner — David Gray
Assistant Examiner — Carla Therrien
(74) *Attorney, Agent, or Firm* — Alleman Hall McCoy Russell & Tuttle LLP

(57) **ABSTRACT**

A fixing device including: arms that support the heating roller and the pressure roller so as to be displaced between a pressure-contact attitude in which a nip portion is formed and a distanced attitude in which the nip portion is released; a solenoid that displaces the rollers to the distanced attitude; a separation plate that has an electric conductivity, is disposed to face the heating roller, and separates the sheet that has passed through the nip portion from the heating roller; and interlocking arms that, in interlock with displacement from the pressure-contact attitude to the distanced attitude by the solenoid, displace a first end portion of the separation plate to an attitude to be distanced away from the heating roller by a first distance, change the potential of the separation plate from a floating potential to a reference potential, and accelerate discharge between the heating roller and the separation plate.

8 Claims, 7 Drawing Sheets

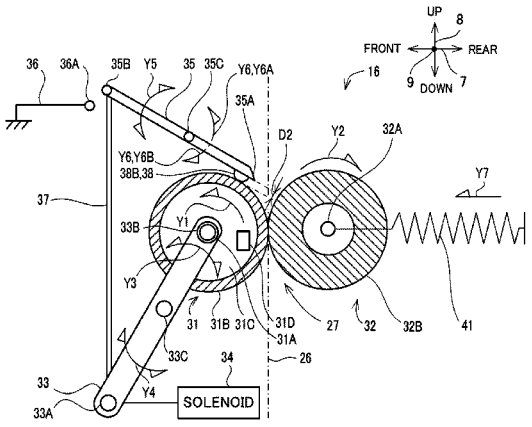
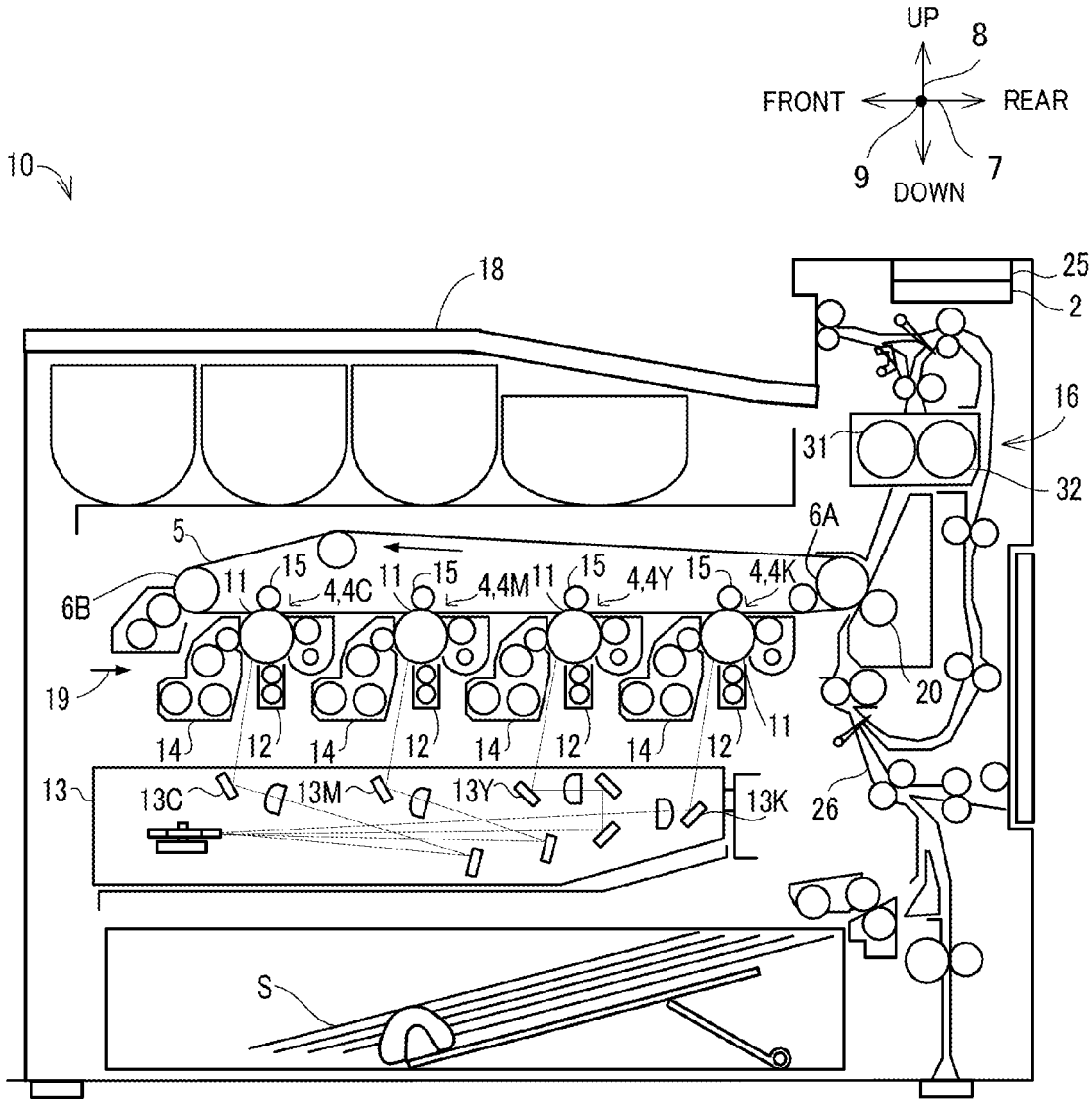


FIG. 1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18
25
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16
31
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6A
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6B
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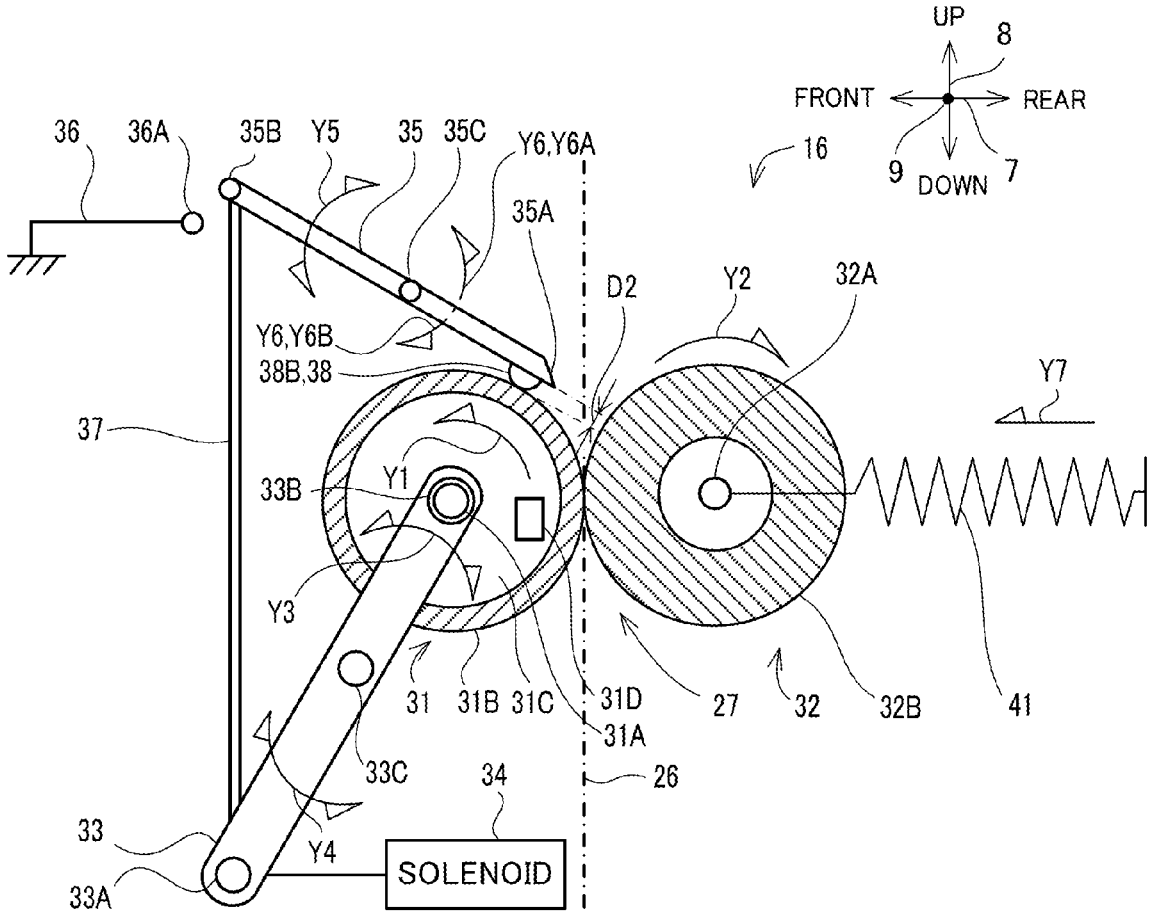
4,4C
4,4M
4,4Y
4,4K
19
20
14
12
13
13C
13M
13Y
13K
26
S

FIG. 2A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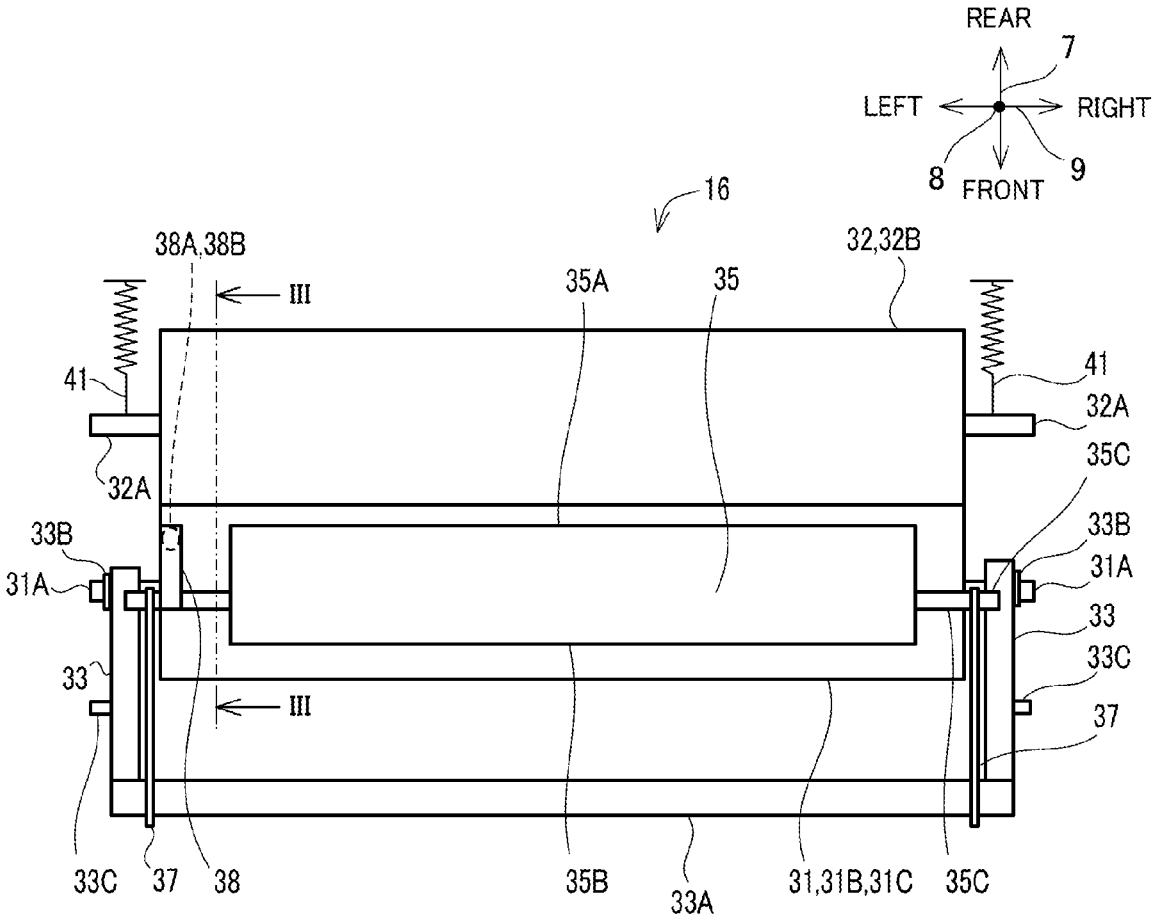
36
36A
35B
Y5
35
35C
Y6,Y6A
35A
D2
Y2
32A
Y6,Y6B
38B,38
Y7
37
33B
Y1
Y3
31
31B
31C
31D
31A
27
32
32B
41
33C
34
26
33
Y4
SOLENOID
33A

FIG. 2B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35
32,32B
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35C
33B
33B
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31A
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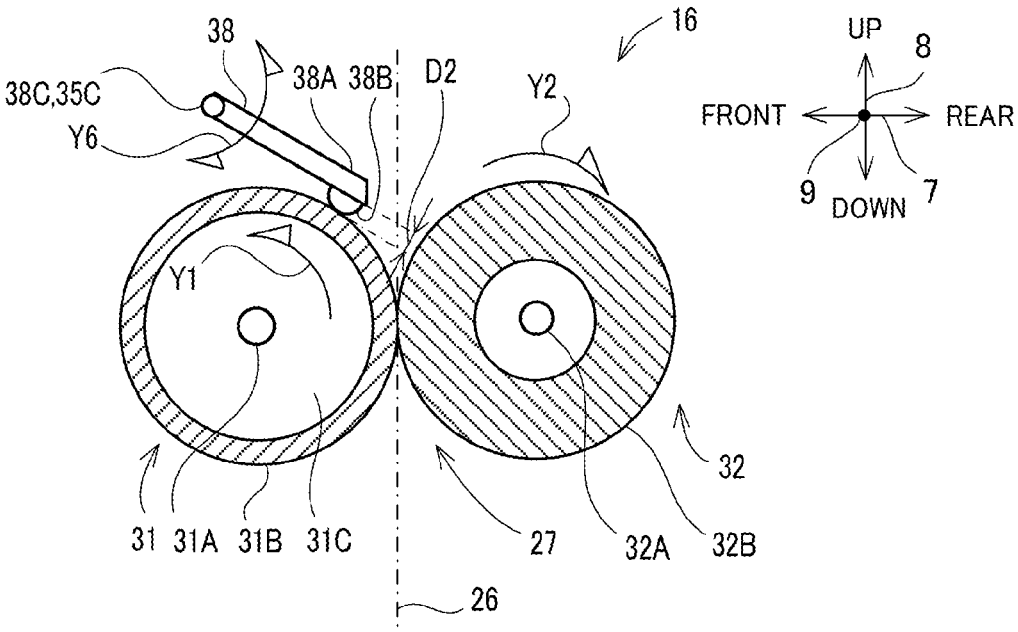
III
37
33C
37
38
35B
33A
31,31B,31C
35C

FIG. 3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38
38C,35C
Y6
38A
38B
D2
Y2
UP
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REAR
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DOWN
7
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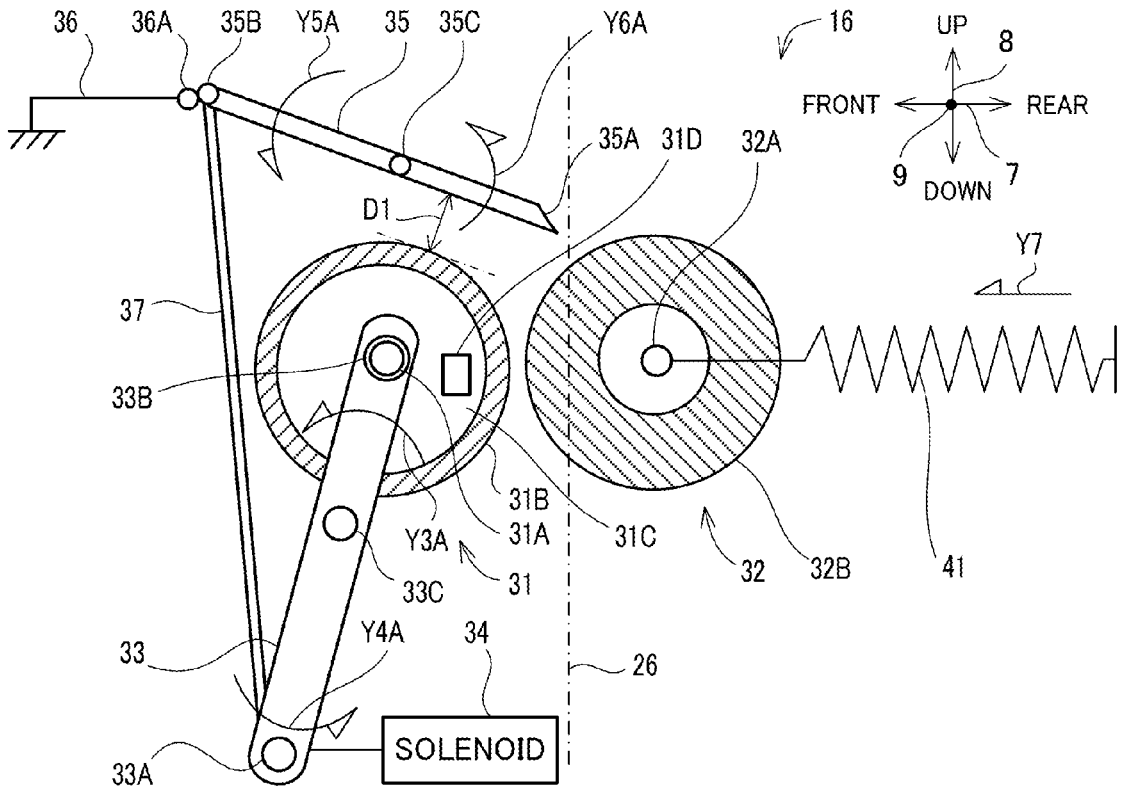
31B
31C
27
32
32A
32B
26

FIG. 4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36A
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Y5A
35
35C
Y6A
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UP
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FRONT
REAR
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DOWN
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35A
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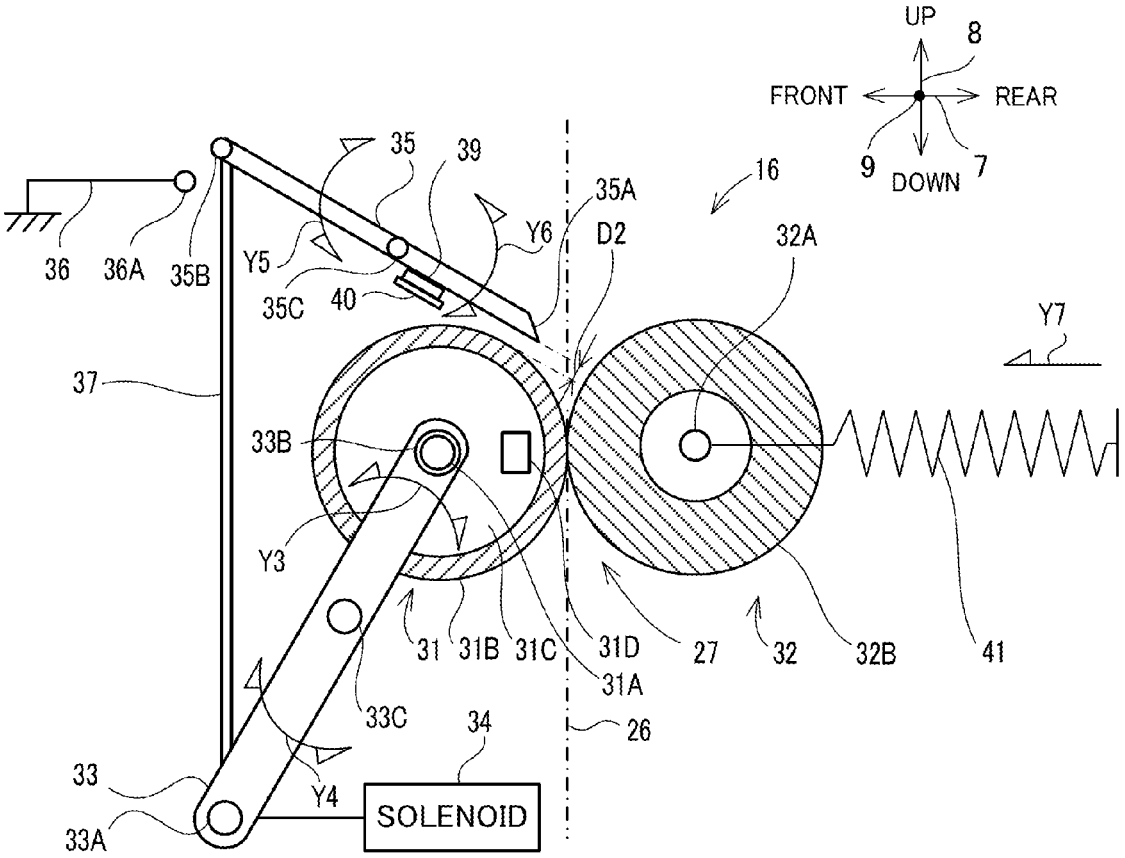
32A
D1
Y7
37
33B
31B
31A
31C
Y3A
31
32
32B
41
33C
33
Y4A
34
26
SOLENOID
33A

FIG. 5A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35A
Y6
D2
32A
Y7
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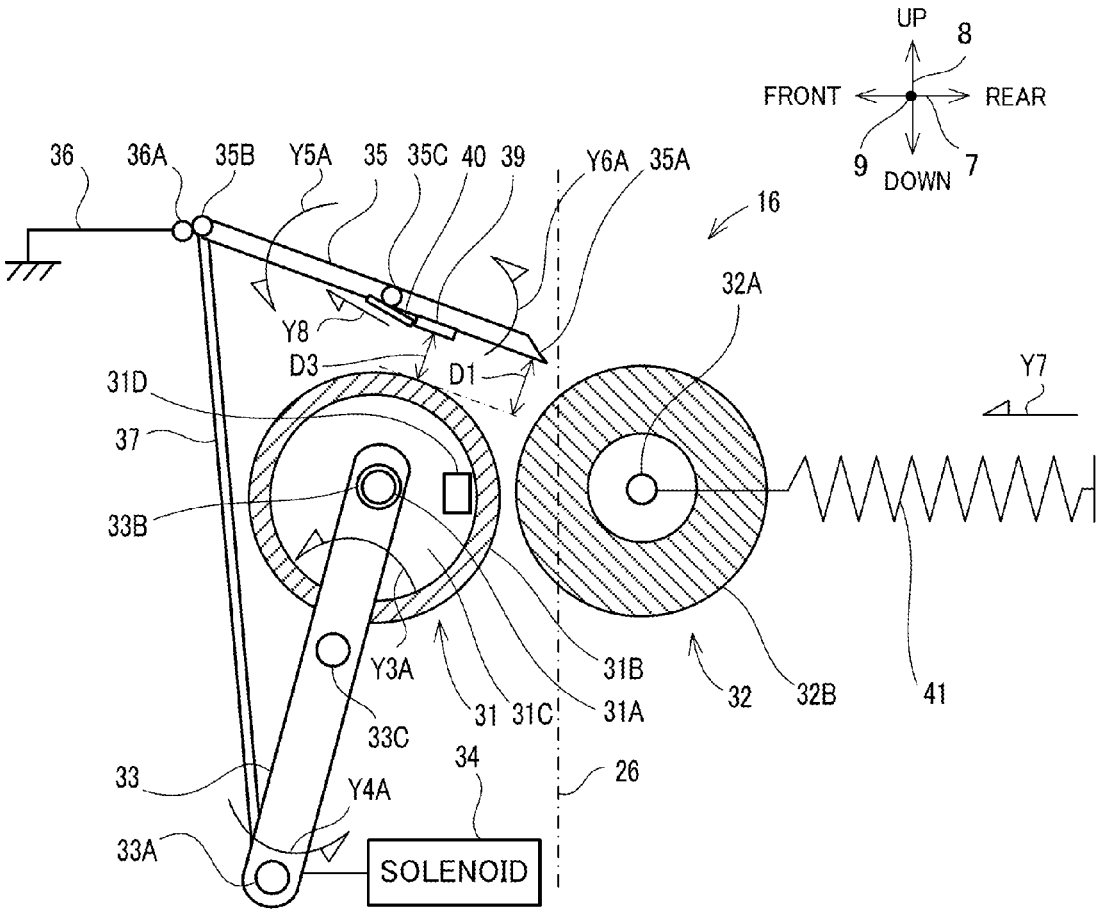
36A
35B
Y5
35C
40
37
33B
Y3
31
31B
31C
31D
27
32
32B
41
31A
26
33C
34
33
Y4
SOLENOID
33A

FIG. 5B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Y5A
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35C
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Y6A
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32A
Y8
D3
D1
Y7
31D
37
33B
Y3A
31B
31
31C
31A
32
32B
41
33C
34
26
33
Y4A
33A
SOLENOID

FIXING DEVICE AND IMAGE FORMING APPARATUS INCLUDING THE SAME

INCORPORATION BY REFERENCE

This application is based upon and claims the benefit of priority from the corresponding Japanese Patent Application No. 2014-137619 filed on Jul. 3, 2014, the entire contents of which are incorporated herein by reference.

BACKGROUND

The present disclosure relates to a fixing device including a separation member for separating a sheet that has stuck to a rotator such as a fixing rotator, and to an image forming apparatus including the fixing device.

An image forming apparatus such as a printer, a facsimile or a copier includes a fixing device that applies heat and pressure to a sheet with toner thereon so that the toner is fixed to the sheet. The fixing device includes a fixing rotator and a pressure rotator, wherein the fixing rotator transmits the heat to the sheet, and the pressure rotator is made pressure-contact with the fixing rotator, and a nip portion is formed when the rotators make pressure-contact with each other. When the sheet passes through the nip portion, a toner image carried on the sheet is fused and fixed to the sheet. The sheet to which the toner image has been fixed is conveyed from the nip portion to the discharge tray. At this time, the sheet may be stuck to the surface of the fixing rotator due to the adhesive force of the fused toner, resulting in a conveyance error and occurrence of a paper jam. As a result, a separation member may be disposed on more downstream side than the nip portion in the rotation direction of the fixing rotator such that the sheet is separated from the fixing rotator by the separation member.

The separation member includes a contact type and a non-contact type, wherein the contact-type separation member causes a separation claw to be in contact with the surface of the fixing rotator, and the non-contact-type separation member separates the sheet by using a thin metal separation plate disposed at a position distanced away from the surface of the fixing rotator. Color image forming apparatuses are more easily influenced than monochrome image forming apparatuses by a flaw generated on the surface of the fixing rotator and a potential difference generated on the surface of the fixing rotator. As a result, many color image forming apparatuses include a separation plate which is a non-contact-type member. In that case, it is necessary to maintain, with a high accuracy, a gap between the surface of the fixing rotator and a tip of the separation plate that is close to the fixing rotator.

In general, a color toner image is composed of overlaid toner images of different colors, and thus has a larger amount of toner carried on the sheet than a monochrome toner image. As a result, in color image forming apparatuses, a sheet is likely to stick to the surface of the fixing rotator by the fused toner. To prevent the sheet from sticking, the surface of the fixing rotator is often made of a fluorine material. For example, in the case where the fixing rotator is a fixing roller, the surface of the fixing roller is coated with a layer of pure fluororesin. In the case where the fixing rotator is a fixing belt, a PFA tube (fluororesin tube) is used for the surface of the belt.

In the fixing device as such, when a plurality of sheets having a relatively strong frictional force pass through the nip portion continuously in a low-temperature low-humidity environment, the surface of the fixing rotator is frictionally charged. In the charging series, fluorine is located on the most minus side, wherein the charging series indicate levels of charging that occur when different substances are frictioned. As a result, by the frictional charging, the surface of the fixing rotator is charged in minus. As the number of sheets continuously passing through the nip portion increases, the amount of charging on the surface of the fixing rotator increases. With the increase of the amount of charging, a local discharge may occur between the tip of the separation plate and the surface of the fixing rotator. In that case, the surface of the fixing rotator will have a part from which electricity has been removed by the local discharge, and a part where the charged state is maintained. When the part from which electricity has been removed approaches the nip portion as the fixing rotator rotates, a phenomenon called electrostatic scattering occurs in which toner that has not been fixed to the sheet is scattered.

As the countermeasure for the electrostatic scattering, there are known, for example, a method of forming the surface of the fixing roller from a material other than the pure fluorine, a method of removing electric charges from the separation plate, and a method of making the separation plate electrically floating. For example, as the method of forming the surface of the fixing roller from a material other than the pure fluorine, the fixing rotator is formed from an electrically conductive PFA tube mixed with an electrically conductive material such as carbon. This restricts electric charges from being charged on the surface of the fixing rotator. However, this method introduces another problem where toner and paper dust stick to the surface of the fixing rotator. This is because the electrically conductive PFA tube has less sheet separation performance than pure-fluorine-based PFA tube. As the method of removing electric charges from the separation plate, for example, a separation plate having a polished end portion may be used. In this method, a local discharge is generated frequently onto the separation plate from the surface of the fixing rotator so as to restrict the amount of charging on the surface of the fixing rotator. However, since it is difficult to control the location and the frequency of the local discharge occurrence, the method could not be the fundamental solution to the electrostatic scattering. As the method of making the separation plate electrically floating, for example, a discharge path in which electric charges flow may be interrupted. This makes it possible to restrict the local discharge from being generated, and restrict the electrostatic scattering. However, with the increase of the amount of charging on the surface of the fixing rotator and the rise of the potential, problems such as electromagnetic wave noise in the image forming apparatus and abnormality in the image fixed on the sheet may occur. In addition, the charging of the separation plate itself may cause the sheet to slide on the separation plate when being conveyed, leading to problems such as an image quality degradation and even a paper jam.

As a conventional technology dealing with the above-mentioned problem, there is known an image forming apparatus that restricts the electrostatic scattering by switching the fixing rotator and the pressure rotator between the grounding state and the floating state.

SUMMARY

A fixing device according to an aspect of the present disclosure includes a first rotator, a second rotator, a support mechanism, a displacement mechanism, a separation member, and an interlocking mechanism. The first rotator transmits heat to a sheet on which a toner image has been transferred. The second rotator forms a nip portion by making pressure-contact with the first rotator and applies pressure to the sheet passing through the nip portion. The support mechanism supports the first rotator and the second rotator in such a

way as to be displaced between a pressure-contact attitude in which the first rotator and the second rotator make pressure-contact with each other and form the nip portion and a distanced attitude in which the first rotator and the second rotator are distanced away from each other and release the nip portion. The displacement mechanism transmits a driving force to any of the first rotator and the second rotator such that the first rotator and the second rotator are displaced in attitude between the pressure-contact attitude and the distanced attitude. The separation member has an electric conductivity, is extended toward the first rotator, includes a first end portion on a side of the first rotator, and separates the sheet that has passed through the nip portion from the first rotator by using the first end portion. The interlocking mechanism, in interlock with a displacement from the pressure-contact attitude to the distanced attitude by the displacement mechanism, displaces the first end portion in a first direction of going away from the first rotator, and causes the separation member to be in a first state where the separation member is conducted with a predetermined reference potential member having a reference potential so that a potential of the separation member becomes the reference potential, and discharge from the first rotator to the separation member is accelerated.

An image forming apparatus according to another aspect of the present disclosure includes the fixing device.

This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description with reference where appropriate to the accompanying drawings. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter. Furthermore, the claimed subject matter is not limited to implementations that solve any or all disadvantages noted in any part of this disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagram showing the configuration of an image forming apparatus according to the first embodiment of the present disclosure.

FIG. **2**A and FIG. **2**B are diagrams showing the configuration of a fixing device according to the first embodiment of the present disclosure.

FIG. **3** is a diagram showing a positioning member of the fixing device according to the first embodiment of the present disclosure.

FIG. **4** is a diagram showing a pressure-contact attitude and a distanced attitude of the fixing device according to the first embodiment of the present disclosure.

FIG. **5**A and FIG. **5**B are diagrams showing the pressure-contact attitude and the distanced attitude of the fixing device according to the second embodiment of the present disclosure.

DETAILED DESCRIPTION

The following describes the first embodiment and the second embodiment of the present disclosure with reference to the accompanying drawings. It should be noted that the following description includes examples of specific embodiments of the present disclosure and should not limit the technical scope of the disclosure.

First Embodiment

Image Forming Apparatus **10**

The following describes an outlined configuration of an image forming apparatus **10** according to the first embodiment of the present disclosure with reference to FIG. **1**. It is noted that for the sake of explanation, the vertical direction in the installment state (the state shown in FIG. **1**) where the image forming apparatus **10** is installed in a usable manner is defined as an up-down direction **8**. In addition, a left-right direction **9** is defined on the supposition that the plane of FIG. **1** is the right surface in the above-mentioned installment state. Furthermore, a front-rear direction **7** is defined on the supposition that the left side of FIG. **1** is the front side and the right side of FIG. **1** is the rear side in the above-mentioned installment state.

As shown in FIG. **1**, the image forming apparatus **10** is a so-called tandem color image forming apparatus, and includes a control portion **2**, a plurality of image forming units **4**, an intermediate transfer belt **5**, a driving roller **6**A, a driven roller **6**B, an optical scanning device **13**, a secondary transfer roller **20**, a fixing device **16**, a sheet tray **18**, an operation display portion **25**, and a conveyance path **26**. The image forming apparatus **10** forms a monochrome image or a color image on a sheet S based on input image data. It is noted that the sheet S is an example of the sheet of the present disclosure and is a sheet-like material such as a sheet of paper, a sheet of coated paper, a postcard, an envelope, or an OHP sheet. In addition, other examples of the image forming apparatus of the present disclosure include a facsimile, a copier, and a multifunction peripheral.

Image forming units are arranged in order of an image forming unit **4**K for black, an image forming unit **4**Y for yellow, an image forming unit **4**M for magenta, and an image forming unit **4**C for cyan in an alignment along the running direction (the direction indicated by the arrow **19**) of the intermediate transfer belt **5**. The image forming units **4** (**4**K, **4**Y, **4**M and **4**C) each include a photoconductor drum **11**, a charging device **12**, a developing device **14**, and a primary transfer roller **15**.

Fixing Device **16**

FIG. **2**A is a side view of the fixing device **16**. FIG. **2**B is a top view of the fixing device **16**. As shown in FIG. **2**A and FIG. **2**B, the fixing device **16** includes a heating roller **31** (an example of the first rotator of the present disclosure), a pressure roller **32** (an example of the second rotator of the present disclosure), a pair of arms **33**, a solenoid **34** (an example of the displacement mechanism of the present disclosure), a separation plate **35** (an example of the separation member of the present disclosure), a pair of interlocking arms **37** (an example of the interlocking mechanism of the present disclosure), a ground wire **36** (an example of the reference potential portion of the present disclosure), a positioning member **38** (an example of the abutting portion of the present disclosure), and biasing springs **41**. It is noted that the arms **33** and the biasing springs **41** are an example of the support mechanism of the present disclosure.

The heating roller **31** tramsmits heat to the sheet S on which a toner image has been transferred. The heating roller **31** includes a roller body **31**C having a cylindrical shape. During fixing, a roller surface **31**B of the roller body **31**C contacts a development surface (a surface to which the toner image has been adhered) of the sheet S. The roller body **31**C is made of a material having a high thermal conductivity, for example, a metal such as aluminum. The surface of the roller body **31**C is coated with a fluororesin layer to facilitate toner separation. Opposite end portions of the roller body **31**C are respectively provided with rotation shafts **31**A which are rotationally supported by roller support portions **33**B of the arms **33** respectively. The rotation shafts **31**A of the heating roller **31** are

connected with a motor that is driven and controlled by the control portion **2** (see FIG. **1**). When the motor is rotationally driven, the rotational driving force is transmitted to the heating roller **31**, and the heating roller **31** rotates counterclockwise (arrow Y**1**) in FIG. **2**A.

The heating roller **31** includes a heater **31**D. The heater **31**D is disposed inside the roller body **31**C. The heater **31**D is composed of, for example, a halogen lamp. The heater **31**D extends inside the roller body **31**C in the axis direction thereof, and heats the whole region of the roller body **31**C in the axis direction from inside. It is noted that the heater **31**D is a mere example of a heating device and may be replaced with another heating device such as an induction heating device that heats the heating roller **31** itself by the action of the magnetic flux.

The pressure roller **32** is disposed to face, and in parallel with, the heating roller **31**. In FIG. **2**A, the pressure roller **32** is on the right side of the heating roller **31**. The pressure roller **32** is supported so as to be rotatable in a pressure-contact attitude where it is made pressure-contact with the surface of the heating roller **31** by a predetermined pressure. Specifically, a rotation shaft **32**A is provided at the center of the pressure roller **32**, and the rotation shaft **32**A is rotationally supported by the biasing springs **41**. This allows the pressure roller **32** to rotate. The pressure roller **32** includes an elastic portion **32**B having a cylindrical shape and made of an elastic material such as silicon or porous rubber. The pressure roller **32** is made pressure-contact with the heating roller **31** by the biasing springs **41** (arrow Y**7**). With this configuration, when the elastic portion **32**B is made pressure-contact with the roller body **31**C, the elastic portion **32**B is elastically deformed to a dented curve such that a nip portion **27** is formed between the heating roller **31** and the pressure roller **32**. In addition, the pressure roller **32** follows the rotation of the heating roller **31** by the contact friction at the nip portion **27**, and rotates clockwise (arrow Y**2**) in FIG. **2**A. Due to the rotation of the heating roller **31** and the pressure roller **32**, the sheet S is conveyed so as to pass through the nip portion **27** from below to above. The pressure roller **32** applies pressure to the sheet S when it passes through the nip portion **27**.

The pair of arms **33** rotationally support the heating roller **31** at the opposite ends of the heating roller **31** in the left-right direction **9** such that the heating roller **31** can be positionally displaced. Each arm **33** includes a roller support portion **33**B and a pivoting shaft **33**C. The roller support portion **33**B is provided at an end portion of the arm **33** and rotationally supports the rotation shaft **31**A of the heating roller **31**. The pivoting shaft **33**C is supported by the housing of the fixing device **16**, and becomes a pivoting shaft of the arm **33** when the arm **33** is pivoted. In addition, a transmitted portion **33**A that extends in the left-right direction **9** is provided to connect the other end portions of the arms **33** with each other. The transmitted portion **33**A receives a driving force transmitted from the solenoid **34**. This enables the arms **33** to receive the driving force transmitted from the solenoid **34** (arrow Y**4**) and displace the heating roller **31** with respect to the pressure roller **32**, the arms **33** supporting the heating roller **31** so as to be displaced between the pressure-contact attitude and a distanced attitude (arrow Y**3**). In the pressure-contact attitude, the heating roller **31** and the pressure roller **32** are made pressure-contact with each other and the nip portion **27** is formed therebetween. In the distanced attitude, the heating roller **31** and the pressure roller **32** are distanced away from each other and the nip portion **27** is released. The displacement between the pressure-contact attitude and the distanced attitude by the arms **33** is described in detail below.

Separation Plate **351**

The separation plate **35** is disposed more on the downstream side in the sheet S conveyance direction than the nip portion **27**, to face the heating roller **31**. The separation plate **35** is configured to separate the sheet S having passed through the nip portion **27** from the heating roller **31**, to prevent the sheet S from being stuck and wound around the heating roller **31**. The separation plate **35** is a plate-like member composed of a first end portion **35**A (an example of the first end portion of the present disclosure); a second end portion **35**B (an example of the second end portion of the present disclosure); and a rotation shaft **35**C (an example of the rotation shaft of the present disclosure), and is long in axis direction of the heating roller **31** (left-right direction **9**). The rotation shaft **35**C extends in a direction parallel to the rotation shafts **31**A of the heating roller **31**, and rotationally supports the separation plate **35**. The first end portion **35**A extends from the rotation shaft **35**C toward the heating roller **31** and its tip has a sharpened shape. Specifically, the first end portion **35**A extends from the rotation shaft **35**C in a direction against the rotation direction (arrow Y**1**) of the heating roller **31**. The direction in which the first end portion **35**A extends is approximately parallel to the direction of a tangent of the heating roller **31**, or intersects with the direction of the tangent at a predetermined angle. In the pressure-contact attitude, the sheet S having passed through the nip portion **27** is separated from the heating roller **31** by the first end portion **35**A. The second end portion **35**B extends from the rotation shaft **35**C in an opposite direction to the first end portion **35**A. In the pressure-contact attitude, the second end portion **35**B is distanced away from the ground wire **36**, and in the distanced attitude, the second end portion **35**B is in contact with the ground wire **36**. The ground wire **36** is connected with a predetermined reference potential member having a reference potential. When the separation plate **35** is connected with the ground wire **36**, the separation plate **35** is conducted therewith and its potential becomes the reference potential. It is noted that the reference potential is not limited to the ground potential. The rotation of the separation plate **35** is described below together with the pivoting by the arms **33**.

In the pressure-contact attitude, the first end portion **35**A of the separation plate **35** is distanced away from the roller surface **31**B of the heating roller **31** by a second distance D**2**, and is not in contact with the roller surface **31**B. It is noted that although a contact portion **38**B of the positioning member **38** appears to be integrally formed with the separation plate **35** in FIG. **2**A, as shown in FIG. **2**B, actually, the positioning member **38** is disposed on the left side of the separation plate **35**, with a certain distance therebetween. As described below, in the pressure-contact attitude, the contact portion **38**B contacts the roller surface **31**B, and the first end portion **35**A is not in contact with the roller surface **31**B. The leading edge of the sheet S that has passed through the nip portion **27** floats above the roller surface **31**B of the heating roller **31**. This is because toner does not adhere to the leading edge and thus sticking due to the fused toner does not occur, and a bending repulsive force of the sheet S is likely to occur. At the timing when the sheet S comes out of the nip portion **27**, the separation plate **35** is positioned between the roller surface **31**B of the roller body **31**C and the leading edge of the sheet S. As a result, the separation plate **35** can separate the sheet S from the heating roller **31**.

As shown in FIG. **2**B, the positioning member **38** is provided outside the area of the heating roller **31** in which the sheet S passes through the nip portion **27**. FIG. **3** is a cross sectional view taken along the line III-III of FIG. **2**B. The positioning member **38** extends from the rotation shaft **35**C in parallel to and by the same length as the first end portion **35**A. The positioning member **38** includes the contact portion **38**B (see FIG. **3**) that is made of an insulating material. The contact portion **38**B is disposed at an extension end **38**A (see FIG. **3**) of the positioning member **38** that faces the heating roller **31**. As shown in FIG. **2**A and FIG. **3**, the thickness of the contact portion **38**B is the same as the second distance D**2** that is shorter than a first distance D**1** described below. In the pressure-contact attitude, in the state where the separation plate **35** is close to the heating roller **31**, the contact portion **38**B of the positioning member **38** is caused to abut on the heating roller **31**. As a result, a gap for separating the sheet S is formed between the first end portion **35**A and the roller surface **31**B of the heating roller **31**, wherein a distance of the gap therebetween is the same as the second distance D**2**.

The separation plate **35** is made of an electrically conductive material such as a metal or a conductive resin. In the fixing device **16** as such, when a plurality of sheets S having a strong frictional force pass through the nip portion **27** continuously in a low-temperature low-humidity environment, the surface of the roller surface **31**B of the heating roller **31** is frictionally charged. As the number of sheets S continuously passing through the nip portion **27** increases, the amount of charging on the surface of the roller surface **31**B increases. If the second end portion **35**B were in contact with the ground wire **36**, the amount of charging would increase, and a local discharge might occur between the first end portion **35**A of the separation plate **35** that is in the non-contact state and the roller surface **31**B of the heating roller **31**. In that case, the surface of the roller surface **31**B of the heating roller **31** would have a part from which electricity has been removed by the local discharge, and a part where the charged state is maintained. Then when the part from which electricity has been removed approaches the nip portion **27** as the heating roller **31** rotates, a phenomenon in which toner that has not adhered to the sheet S is scattered occurs. Here, if the second end portion **35**B were distanced away from the ground wire **36**, the local discharge between the heating roller **31** and the separation plate **35** would be restricted. However, since the amount of charging on the surface of the roller surface **31**B increases and the potential of the surface increases, problems such as electromagnetic wave noise in the image forming apparatus **10** and abnormality in the image fixed on the sheet S may occur. In addition, the charging of the separation plate **35** itself may cause the sheet S to stick thereto, leading to a problem such as a paper jam. On the other hand, the fixing device **16** of the first embodiment is configured such that, in the pressure-contact attitude, the second end portion **35**B of the separation plate **35** is distanced away from a terminal **36**A of the ground wire **36**, with the separation plate **35** being in the floating potential state, and thus the local discharge is restricted. Here, the floating potential refers to an independent potential which is generated in a member when the member is not in electrical contact with another member such as the ground wire **36**. Furthermore, when an image formation is completed, the second end portion **35**B of the separation plate **35** is connected with the terminal **36**A of the ground wire **36**. This allows a local discharge to be generated between the first end portion **35**A of the separation plate **35** that is in the non-contact state and the roller surface **31**B, and electric charges on the charged roller surface **31**B are removed. In this way, the fixing device **16** of the first embodiment can remove electric charges from the heating roller **31** that is charged during a non-image-formation period, while restricting generation of a local discharge between the separation plate **35** and the heating roller **31** during an image formation period. The following describes a mechanism for displacing the attitude of the separation plate **35** in interlock with the positional displacement of the heating roller **31**.

Interlocking Between Positional Displacement of Heating Roller **31** and Attitudinal Displacement of Separation Plate **35**

As shown in FIG. **2**A, the solenoid **34** transmits a driving force to the transmitted portion **33**A such that the transmitted portion **33**A, together with the arms **33**, pivots around the pivoting shaft **33**C (arrow Y**4**). This allows the roller support portion **33**B, which supports the rotation shafts **31**A of the heating roller **31**, to be moved toward and away from the pressure roller **32** (arrow Y**3**). In this way, the solenoid **34** transmits a driving force to the heating roller **31** such that the heating roller **31** and the pressure roller **32** are displaced in attitude between the pressure-contact attitude and the distanced attitude.

One end portion of each interlocking arm **37** is connected with the transmitted portion **33**A, and the other is connected with the second end portion **35**B of the separation plate **35**. The interlocking arms **37** transmit the driving force of the solenoid **34** to the separation plate **35** so as to interlock the positional displacement of the heating roller **31** with the attitudinal displacement of the separation plate **35**. When the transmitted portion **33**A is pivoted by the solenoid **34** (arrow Y**4**), the second end portion **35**B of the separation plate **35** is also pivoted (arrow Y**5**), and the first end portion **35**A is pivoted around the rotation shaft **35**C (arrow Y**6**). The interlocking arms **37** cause the separation plate **35** to rotate around the rotation shaft **35**C between the first attitude and the second attitude. In the first attitude, the interlocking arms **37** cause the separation plate **35** to be in a first state where the first end portion **35**A is distanced away from the heating roller **31** by the first distance D**1**, the second end portion **35**B is connected with the ground wire **36**, and the separation plate **35** is conducted with the ground wire **36**. More specifically, in interlock with the displacement from the pressure-contact attitude to the distanced attitude by the solenoid **34**, the interlocking arms **37** cause the separation plate **35** to rotate from the second attitude to the first attitude. The interlocking arms **37** cause the first end portion **35**A to be displaced in the first direction (see arrow Y**6**A of FIG. **2**A) of going away from the heating roller **31**. In addition, the interlocking arms **37** cause the second end portion **35**B to be conducted with the ground wire **36** so that the potential of the separation plate **35** becomes the reference potential. In the first attitude, the potential difference between the heating roller **31** and the separation plate **35** increases, and therefore the discharge from the heating roller **31** to the separation plate **35** is accelerated. On the other hand, in the second attitude, the interlocking arms **37** cause the separation plate **35** to be in a second state where the first end portion **35**A is distanced away from the heating roller **31** by the second distance D**2**, the second end portion **35**B is not in contact with the ground wire **36**, and the separation plate **35** is not conducted with the ground wire **36**. More specifically, in interlock with the displacement from the distanced attitude to the pressure-contact attitude by the solenoid **34**, the interlocking arms **37** cause the separation plate **35** to rotate from the first attitude to the second attitude. The interlocking arms **37** cause the first end portion **35**A to be displaced in the second direction (see arrow Y**6**B of FIG. **2**A)

of approaching the heating roller **31**. In addition, the interlocking arms **37** cause the second end portion **35**B not to be conducted with the ground wire **36** so that the potential of the separation plate **35** changes from the reference potential to the floating potential. In the second attitude, the potential difference between the heating roller **31** and the separation plate **35** decreases, and therefore the discharge from the heating roller **31** to the separation plate **35** is restricted.

As shown in FIG. **4**, when the solenoid **34** pulls the transmitted portion **33**A rearward in the front-rear direction **7** (arrow Y**4**A), the attitude of the heating roller **31** changes from the pressure-contact attitude to the distanced attitude (arrow Y**3**A). The interlocking arms **37** cause the second end portion **35**B to pivot toward the terminal **36**A of the ground wire **36** (arrow Y**5**A) and causes the first end portion **35**A to pivot in the first direction of going away from the heating roller **31** (arrow Y**6**A). In other words, the first end portion **35**A is displaced by the interlocking arms **37** to the first attitude where it is distanced away from the heating roller **31** by the first distance D**1**. Together with this, by the interlocking arms **37**, the second end portion **35**B is connected and conducted with the terminal **36**A of the ground wire **36**. In this case, the whole separation plate **35** is grounded and the potential of the separation plate **35** becomes the reference potential. As a result, when the heating roller **31** has been charged and the potential difference is large, the separation plate **35** is in the first attitude by which the discharge between the heating roller **31** and the separation plate **35** is accelerated.

On the other hand, as shown in FIG. **2**A, when the solenoid **34** pushes the transmitted portion **33**A frontward in the front-rear direction **7**, the attitude of the heating roller **31** changes from the distanced attitude to the pressure-contact attitude. The interlocking arms **37** cause the second end portion **35**B to pivot in a direction of going away from the terminal **36**A of the ground wire **36** and causes the first end portion **35**A to pivot in the second direction of approaching the heating roller **31** (arrow Y**6**B). In other words, the first end portion **35**A is displaced by the interlocking arms **37** to the second attitude where it is distanced away from the heating roller **31** by the second distance D**2**. In the second attitude, if the sheet S passes through the nip portion **27**, the sheet S is separated from the heating roller **31** by the first end portion **35**A. In addition, by the interlocking arms **37**, the second end portion **35**B is distanced away from, and is not conducted with the terminal **36**A of the ground wire **36**. In this case, the potential of the whole conductive bseparation plate **35** becomes the floating potential. As a result, when the heating roller **31** is charged, the potential state of the separation plate **35** is interlocked with it. Therefore the separation plate **35** takes the second attitude by which the discharge between the heating roller **31** and the separation plate **35** is restricted.

Furthermore, as shown in FIG. **3**, the interlocking arms **37** displace the attitude of the positioning member **38**, as well as the attitude of the separation plate **35**. In response to the change of attitude by the solenoid **34** from the pressure-contact attitude to the distanced attitude, the interlocking arms **37** cause the contact portion **38**B of the positioning member **38** to be distanced away from the heating roller **31**. In addition, in response to the change of attitude by the solenoid **34** from the distanced attitude to the pressure-contact attitude, the interlocking arms **37** causes the contact portion **38**B of the positioning member **38** to abut on the heating roller **31**. The contact portion **38**B is disposed at the extension end **38**A of the positioning member **38** that faces the heating roller **31**. As a result, in the pressure-contact attitude, the solenoid **34** keeps the distance of the gap between the separation plate **35** and the surface of the heating roller **31** to be the second distance D**2** that is the same as the thickness of the contact portion **38**B.

As described above, the fixing device **16** includes the interlocking arms **37** and the separation plate **35**, wherein the interlocking arms **37** displace the attitude of the separation plate **35** in interlock with the positional displacement of the heating roller **31**, and the separation plate **35** changes its attitude. With such a simple configuration, the fixing device **16** can restrict the discharge between the heating roller **31** and the separation plate **35** during an image formation period, and restrict the electrostatic scattering by discharging electric charges that have been charged on the heating roller **31** during a non-image-formation period.

Furthermore, compared to a conventional image forming apparatus that restricts the electrostatic scattering by switching the fixing rotator and the pressure rotator between the grounding state and the floating state, the above-described configuration of the fixing device **16** enables the electrostatic scattering to be restricted by a simple configuration.

Second Embodiment

According to the above-described first embodiment, the attitude of the separation plate **35** is displaced in correspondence with the positional displacement of the heating roller **31**. However, the present disclosure is not limited to the configuration. For example, it is possible to have a configuration where, in the pressure-contact attitude, the discharge from the heating roller **31** is restricted, and in the distanced attitude, the discharge of electric charges from the heating roller **31** is accelerated. In the second embodiment, the separation plate **35** includes an electricity removing sheet **39** and a cover **40**, and the attitude of the cover **40** is displaced by the interlocking arms **37**. Here, the second embodiment differs from the first embodiment in that the separation plate **35** includes the electricity removing sheet **39** and the cover **40**, and the attitude of the cover **40** is displaced by the interlocking arms **37** based on the change between the pressure-contact attitude and the distanced attitude. Otherwise, the second embodiment has configurations and the like that are common to the first embodiment. As a result, in the following description of the present embodiment, only the difference from the first embodiment is described, and description of common configurations is omitted.

Separation Plate **35**

FIG. **5**A shows the fixing device **16** in the pressure-contact attitude. FIG. **5**B shows the fixing device **16** in the distanced attitude. The separation plate **35** includes the electricity removing sheet **39** between the rotation shaft **35**C and a tip of the first end portion **35**A that faces the heating roller **31**. The electricity removing sheet **39** is a sheet formed by, for example, a reaction of a copolymer of polypyrrole with a surface of a base fabric that is formed from polyester ultrafine fiber and polyamide. The electricity removing sheet **39** is a highly conductive member whose electrical conductivity is higher than the separation plate **35**.

As shown in FIG. **5**A, in the pressure-contact attitude, when the separation plate **35** is in the second attitude, the electricity removing sheet **39** is more distanced away from the surface of the heating roller **31** than the first end portion **35**A. On the other hand, as shown in FIG. **5**B, when the separation plate **35** is in the first attitude, the electricity removing sheet **39** is closer to the heating roller **31** than the first end portion **35**A. In other words, a third distance D**3** is shorter than the first distance D**1**, wherein the third distance D**3** is a distance

between the electricity removing sheet **39** and the surface of the heating roller **31**, and the first distance D**1** is a distance between the first end portion **35**A and the surface of the heating roller **31**. Since the electricity removing sheet **39** has higher electrical conductivity than the separation plate **35**, a discharge is likely to occur between the electricity removing sheet **39** and the surface of the heating roller **31**. In addition, when the separation plate **35** is in the second attitude, the electricity removing sheet **39** is more distanced away from the heating roller **31** than the first end portion **35**A. In other words, the third distance D**3** is longer than the first distance D**1**, wherein the third distance D**3** is a distance between the electricity removing sheet **39** and the surface of the heating roller **31**, and the first distance D**1** is a distance between the first end portion **35**A and the surface of the heating roller **31**. Since the separation plate **35** has a lower electrical conductivity than the electricity removing sheet **39**, the discharge between the first end portion **35**A and the surface of the heating roller **31** is restricted.

The cover **40** is an insulating member configured to cover the electricity removing sheet **39**, and restricts the discharge between the electricity removing sheet **39** and the surface of the heating roller **31** by covering the electricity removing sheet **39**.

The interlocking arms **37**, when displacing the attitude of the separation plate **35**, displace the attitude of the cover **40** as well. In the first attitude, the interlocking arms **37** displace the cover **40** to an attitude by which the electricity removing sheet **39** is exposed. This accelerates the discharge between the electricity removing sheet **39** and the surface of the heating roller **31**. In other words, in interlock with a change from the pressure-contact attitude to the distanced attitude made by the solenoid **34**, the interlocking arms **37** displace the cover **40** from an attitude where the electricity removing sheet **39** is covered to an attitude where the electricity removing sheet **39** is exposed (arrow Y**8**).

As described above, the fixing device **16** can accelerate the discharge in the distanced attitude with a configuration where the electricity removing sheet **39** is provided on the separation plate **35** whose attitude is displaced in interlock with the positional displacement of the heating roller **31**. Furthermore, the fixing device **16** can restrict the discharge in the pressure-contact attitude with a configuration where the cover **40** is provided in such a way as to cover or expose the electricity removing sheet **39** in interlock with the attitudinal displacement of the separation plate **35**. In this way, the fixing device **16** of the second embodiment can restrict the electrostatic scattering by a simple configuration.

Modifications of Embodiments

In the first embodiment and the second embodiment, description is given of the separation plate **35** of the non-contact system where the separation plate **35** is distanced away from the heating roller **31**. However, the present disclosure is not limited to this configuration. For example, instead of the separation plate **35**, a separation claw that is displaceable between the first attitude and the second attitude may be used. In that case, in the second attitude, the separation claw may be in contact with the heating roller **31**. As another modification, the separation plate **35** may not include the second end portion **35**B. For example, in the first attitude, a first surface of the separation plate **35** that is on the opposite side from the heating roller **31** may be in contact with the terminal **36**A of the ground wire **36**, and in the second attitude, the first surface of the separation plate **35** may be distanced away from the terminal **36**A of the ground wire **36**. In the first embodiment and the second embodiment, description is given of the separation plate **35** that is displaced between the first attitude and the second attitude by rotating around the rotation shaft **35**C. However, the present disclosure is not limited to this configuration. For example, the whole of the separation plate **35** may be moved toward and away from the heating roller **31**, or the separation plate **35** may be deformed in shape in such a way as to move toward and away from the heating roller **31**. In the case of the configuration where the whole of the separation plate **35** is moved, the whole of the separation plate **35** is distanced away from the heating roller **31** and connected with the ground wire **36** so as to be in the first state, and the whole of the separation plate **35** is approached to the heating roller **31** so as to be able to separate the sheet S and is disconnected from the ground wire **36**, so as to be in the second state. In the case of the configuration where the separation plate **35** is deformed in shape, the separation plate **35** is bent so as to be in the first state where it is distanced away from the heating roller **31** and connected with the ground wire **36**, and the separation plate **35** is made straight so as to be in the second state where it approaches the heating roller **31** so as to be able to separate the sheet S and is disconnected from the ground wire **36**. In this way, the separation plate **35** may be configured to change between the first state and the second state, not displaced in attitude.

In the first embodiment and the second embodiment, the arms **33** and the biasing springs **41** constitute the support mechanism, and the solenoid **34** constitutes the displacement mechanism. However, the present disclosure is not limited to this configuration. For example, the arms **33** and the biasing springs **41** may support the pressure roller **32**, and the solenoid **34** may transmit the driving force to the pressure roller **32** in such a way as to be displaced between the pressure-contact attitude and the distanced attitude. In the embodiments, description is given of the case where the displacement mechanism is the solenoid **34**. However, not limited to this, the displacement mechanism may be, for example, a drive motor. In addition, the interlocking mechanism is not limited to the interlocking arms **37**. For example, the interlocking mechanism may be a transmission member such as a gear and a rotation shaft, or an electric motor that moves in interlock with the solenoid **34**.

In the first embodiment and the second embodiment, the second end portion **35**B is connected with the terminal **36**A so that the potential of the separation plate **35** becomes the reference potential, and the second end portion **35**B is distanced away from the terminal **36**A so that the potential of the separation plate **35** becomes the floating potential. However, the method for switching between the reference potential state and the floating potential state is not limited to that example. For example, a switch may be used to switch between the reference potential state and the floating potential state. In addition, not limited to the ground wire **36**, a grounding member such as a grounding plate may be used, for example.

It is to be understood that the embodiments herein are illustrative and not restrictive, since the scope of the disclosure is defined by the appended claims rather than by the description preceding them, and all changes that fall within metes and bounds of the claims, or equivalence of such metes and bounds thereof are therefore intended to be embraced by the claims.

The invention claimed is:

1. A fixing device comprising:

a first rotator configured to transmit heat to a sheet on which a toner image has been transferred;

a second rotator configured to form a nip portion by making pressure-contact with the first rotator and apply pressure to the sheet passing through the nip portion;

a support mechanism configured to support the first rotator and the second rotator in such a way as to be displaced between a pressure-contact attitude in which the first rotator and the second rotator make pressure-contact with each other and form the nip portion and a distanced attitude in which the first rotator and the second rotator are distanced away from each other and release the nip portion;

a displacement mechanism configured to transmit a driving force to any of the first rotator and the second rotator such that the first rotator and the second rotator are displaced in attitude between the pressure-contact attitude and the distanced attitude;

a separation member having an electric conductivity, extended toward the first rotator, including a first end portion on a side of the first rotator, and configured to separate the sheet that has passed through the nip portion from the first rotator by using the first end portion; and

an interlocking mechanism configured to, in interlock with a displacement from the pressure-contact attitude to the distanced attitude by the displacement mechanism, displace the first end portion in a first direction of going away from the first rotator, and cause the separation member to be in a first state where the separation member is conducted with a predetermined reference potential member having a reference potential so that a potential of the separation member becomes the reference potential, and discharge from the first rotator to the separation member is accelerated.

2. The fixing device according to claim **1**, wherein

when the first rotator and the second rotator are in the pressure-contact attitude, the separation member separates the sheet in a state where the first end portion is not in contact with the first rotator, and

the interlocking mechanism, in interlock with a displacement from the distanced attitude to the pressure-contact attitude by the displacement mechanism, displaces the first end portion in a second direction of approaching the first rotator, and causes the separation member to be in a second state where the separation member is not conducted with the reference potential member so that the potential of the separation member changes from the reference potential to a floating potential, and the discharge from the first rotator to the separation member is restricted.

3. The fixing device according to claim **2**, wherein

the separation member is supported in such a way as to be rotatable between a first attitude and a second attitude around a predetermined rotation shaft, and when the separation member is in the first attitude, the separation member is in the first state where the separation member is conducted with the reference potential member, and when the separation member is in the second attitude, the separation member is in the second state where the separation member is not conducted with the reference potential member, and

the interlocking mechanism, in interlock with the displacement from the pressure-contact attitude to the distanced attitude by the displacement mechanism, causes the separation member to rotate from the second attitude to the first attitude.

4. The fixing device according to claim **3**, wherein

the separation member further includes a second end portion which extends from the rotation shaft in an opposite direction to the first end portion, and in the first attitude, the second end portion is in contact with the reference potential portion, and in the second attitude, the second end portion is not in contact with the reference potential portion.

5. The fixing device according to claim **3**, wherein

the separation member further includes a highly conductive member on a surface thereof that faces the first rotator, the highly conductive member being higher in electrical conductivity than the separation member, and

the highly conductive member is disposed such that when the separation member is in the first attitude, the highly conductive member is closer to the first rotator than the first end portion, and when the separation member is in the second attitude, the highly conductive member is more distanced away from the first rotator than the first end portion.

6. The fixing device according to claim **5**, wherein

the separation member further includes an insulating cover configured to cover the highly conductive member, and

in the second attitude, the interlocking mechanism displaces the cover to an attitude of covering the highly conductive member, and in the first attitude, the interlocking mechanism displaces the cover to an attitude by which the highly conductive member is exposed.

7. The fixing device according to claim **2** further comprising

an abutting portion formed from an insulating member and provided outside an area in which the sheet passes through the nip portion, the abutting portion configured to abut on the first rotator in a state where the separation member is in the second state by the interlocking mechanism, and form a gap for separating the sheet between the first end portion and the first rotator, and

the interlocking mechanism, in interlock with the displacement from the pressure-contact attitude to the distanced attitude by the displacement mechanism, causes the abutting portion to be distanced away from the first rotator.

8. An image forming apparatus comprising the fixing device according to claim **1**.

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